

## ***Appendix A***

### ***Glossary***

# A

## Glossary

**Accident:** An unwanted transfer of energy or an environmental condition that, due to the absence or failure of barriers or controls, produces injury to persons, damage to property, or reduction in process output.

**Accident Investigation:** The systematic appraisal of unwanted events for the purpose of determining causal factors, subsequent corrective actions, and preventive measures.

**Accident or Emergency Response Team:** A team or teams of emergency and accident response personnel for a particular site. This team may be composed of a number of teams from the site, such as local police and firefighter units, emergency medical personnel, and hazardous material teams.

**Analysis:** The use of methods and techniques for arranging data to: (a) assist in determining what additional data are required; (b) establish consistency, validity, and logic; (c) establish necessary and sufficient events for causes; and (d) guide and support inferences and judgments.<sup>1</sup>

**Analytical Tree:** Graphical representation of an accident in a deductive approach (general to specific). The structure resembles a tree—that is, narrow at the top with a single event (accident) and then branching out as the tree is developed, and identifying root causes at the bottom branches.

**Appointing Official:** A designated authority responsible for assigning accident investigation boards for Type A and Type B investigations, with responsibilities as prescribed in DOE Order 225.1A, Paragraph 5.d.

**Barrier:** Anything used to control, prevent, or impede energy flows. Common types of barriers include equipment, administrative procedures and processes, supervision/management, warning devices, knowledge and skills, and physical objects.

**Barrier Analysis:** An analytical technique used to identify energy sources and the failed or deficient barriers and controls that contributed to an accident.

**Board Chairperson:** The leader who manages the accident investigation process, represents DOE in all matters regarding the accident investigation, and reports to the appointing official for purposes of the accident investigation.

**Board Members:** A group of three to six DOE staff assigned to investigate an accident. This group reports to the board chairperson during the accident investigation.

**Causal Factor:** An event or condition in the accident sequence necessary and sufficient to produce or contribute to the unwanted result. Causal factors fall into three categories:

- Direct cause

<sup>1</sup>Ferry, Ted S., *Modern Accident Investigation and Analysis*, 2nd Edition, John Wiley & Sons, New York, New York, 1988.

- Contributing cause
- Root cause.

**Cause:** Anything that contributes to an accident or incident. In an investigation, the use of the word “cause” as a singular term should be avoided. It is preferable to use it in the plural sense, such as “causal factors,” rather than identifying “the cause.”

**Chain of Custody:** The process of documenting, controlling, securing, and accounting for physical possession of evidence, from initial collection through final disposition.

**Change:** Stress on a system that was previously in a state of equilibrium, or anything that disturbs the planned or normal functioning of a system.

**Change Analysis:** An analytical technique used for accident investigations, wherein accident-free reference bases are established, and changes relevant to accident causes and situations are systematically identified. In change analysis, all changes are considered, including those initially considered trivial or obscure.

**Conclusions:** Significant deductions derived from analytical results. Conclusions are derived from and must be supported by the facts, plus results from testing and analyses conducted. Conclusions are statements that answer two questions the accident investigation addresses: what happened and why did it happen? Conclusions include concise recapitulations of the causal factors (direct, contributing, and root causes) of the accident determined by analysis of facts.

**Contributing Cause:** An event or condition that collectively with other causes increases the likelihood of an accident but that individually did not cause the accident.

**Controls:** Those barriers used to control wanted energy flows, such as the insulation on an electrical cord, a stop sign, a procedure, or a safe work permit.

**Direct Cause:** The immediate events or conditions that caused the accident.

**DOE Accident Investigator:** An individual who understands DOE accident investigation techniques and has experience in conducting investigations through participation in at least one Type A or Type B investigation. Effective October 1, 1998, DOE accident investigators must have attended an accident investigation course of instruction that is based on current materials developed by the Office of Deputy Assistant Secretary for Oversight.

**DOE Operations:** Activities funded by DOE for which DOE has authority to enforce environmental protection, safety, and health protection requirements.

**DOE Site:** A tract either owned by DOE, leased, or otherwise made available to the Federal government under terms that afford DOE rights of access and control substantially equal to those it would possess if it held the fee (or pertinent interest therein) as agent of and on behalf of the government. One or more DOE operations/program activities carried out within the boundaries of the described tract.

**Energy:** The capacity to do work and overcome resistance. Energy exists in many forms, including acoustic, potential, electrical, kinetic, thermal, biological, chemical, and radiation (both ionizing and non-ionizing).

**Energy Flow:** The transfer of energy from its source to some other point. There are two types of energy flows: wanted (controlled—able to do work) and unwanted (uncontrolled—able to do harm).

**Event:** An occurrence; something significant and real-time that happens. An accident involves a sequence of events occurring in the course of work activity and culminating in unintentional injury or damage.

**Events and Causal Factors Chart:**

Graphical depiction of a logical series of events and related conditions that precede the accident.

**Eyewitness:** A person who directly observed the accident or the conditions immediately preceding or following the accident.

**Fatal Injury:** Any injury that results in death within 30 calendar days of the accident.

**Field Element:** A general term for all DOE sites (excluding individual duty stations) located outside the Washington, D.C., metropolitan area.

**General Witness:** A person with knowledge about the activities prior to or immediately after the accident (the previous shift supervisor or work controller, for example).

**Hazard:** The potential for energy flow(s) to result in an accident or otherwise adverse consequence.

**Heads of Field Elements:** First-tier field managers of the operations offices, the field offices, and the power marketing administrations (administrators).

**Human Factors:** The study of human interactions with products, equipment, facilities, procedures, and environments used in work and everyday living. The emphasis is on human beings and how the design of equipment influences people.

**Investigation:** A detailed, systematic search to uncover the “who, what, when, where, why, and how” of an occurrence and to determine what corrective actions are needed to prevent a recurrence.

**Investigation Report:** A clear and concise written account of the investigation results.

**Judgments of Need:** Managerial controls and safety measures necessary to prevent or minimize the probability or severity of a recurrence of an accident.

**Lessons Learned:** A “good work practice” or innovative approach that is captured and shared to promote its repeated application. A lesson learned may also be an adverse work practice or experience that is captured and shared to avoid recurrence.

**Limited Scope Investigation:** An accident investigation chartered by the Assistant Secretary for Environment, Safety and Health that is reduced in scope, duration, and resources from that normally associated with a Type A or Type B investigation.

**Occurrence:** An event or condition that adversely affects or may adversely affect DOE or contractor personnel, the public, property, the environment, or DOE mission.

**Occurrence Reporting and Processing System (ORPS):** The reporting system established and maintained for reporting occurrences related to the operation of DOE facilities.

**Point of Contact:** A DOE staff member who is assigned the role of liaison with the Accident Investigation Program Manager in the Office of Security Evaluations (EH-21), who administers the accident investigation program. In this role, the point of contact ensures that site readiness teams are trained in collecting and maintaining initial accident investigation evidence and that their activities are coordinated with accident and emergency response teams.

**Principal Witness:** A person who was actually involved in the accident.

**Readiness Team:** Trained personnel who are available to perform initial investigative response activities immediately following an accident. They are responsible for initiating the accident investigation, maintaining the integrity of evidence before the accident investigation board arrives, and supporting the board after its arrival.

**Requirements Verification Analysis:** A validation technique that determines whether the logical flow of data from analysis to conclusions and judgments of need is based on facts. This technique is conducted after all the analyses are completed.

**Root Cause:** The causal factor(s) that, if corrected, would prevent recurrence of the accident.

**Root Cause Analysis:** Any methodology that identifies the causal factors that, if corrected, would prevent recurrence of the accident.

**Target:** A person, object, or animal upon which an unwanted energy flow may act to cause damage, injury, or death.

## ***Appendix B***

## ***References***

# B

## **References**

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- d. DOE Order 360.1, *Training*, May 31, 1995.
- e. DOE Policy 450.4, *Safety Management System Policy*, October 15, 1996.
- f. DOE Guide 450.4-1, *Integrated Safety Management System Guide*, Revision 0; Volumes 1 and 2, November 26, 1997.
- g. DOE Policy 450.6, *Secretarial Policy Statement Environment, Safety and Health*, April 14, 1998.
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***Appendix C***

***Specific Administrative Needs***



## C

## **Specific Administrative Needs**

### **Roles and Responsibilities of The Administrative Coordinator**

The onsite administrative coordinator assists the board chairperson and board members in the day-to-day activities of the accident investigation. This includes serving as a central point of contact for the board, making arrangements for office facilities and equipment, managing report production, and maintaining investigation records.

Generally, the administrative coordinator (working closely with the board chairperson) is responsible for:

- Arranging for appropriate onsite office/work space and furnishings (including a large conference room that can be locked when not in use by the board, several small, hard-walled offices for conducting interviews, a central area to locate a library of documents collected, and several lockable file cabinets)
- Arranging for local court reporter(s)
- Arranging for security badges/passes for board members and property permits for personal equipment (cameras, computers, etc.)
- Arranging for specific security, access, safety, and health training, as required
- Arranging for telephone service and dedicated fax machine
- Arranging for a dedicated, high-speed copy machine that has collating and stapling capability
- Selecting a hotel and reserving a block of rooms
- Obtaining office supplies and consumables for use by board members and support staff
- Arranging for after-hours access to the site and work space
- Serving as the custodian for all keys provided by the site
- Determining site/field office contact for administrative and logistical support
- Preparing and maintaining interview schedules (if requested by board chairperson)
- Creating and maintaining onsite accident investigation files
- Maintaining chain of custody for evidence (if requested by board chairperson)
- Attending daily board meetings and taking notes to assist the chairperson
- Tracking action items and follow-up activities to completion
- Coordinating report preparation and production activities on site and at Headquarters
- Arranging for shipment of files and records to Headquarters for archiving at the end of the investigation.

***Appendix D***  
***Safety Management System***

# D

## ***Safety Management System***

Board members should use the framework of DOE's integrated safety management system, contained in DOE Policy 450.4, to determine the effectiveness of management systems, the adequacy of policy and policy implementation, and the effectiveness of line management oversight as they relate to the accident. The following two tables contain typical questions board members may ask to evaluate the core functions and guiding principles of integrated safety management.

**Table D-1. These are typical questions for addressing the five core functions of integrated safety management.**

### **Function #1: Define the scope of work.**

- Were the purpose and scope of the work to be performed clearly defined so that workers could identify any unanticipated conditions and actions that would be outside the authorized work scope?
- Were expectations regarding the removal or control of hazards clearly defined and communicated to the workers?
- Were the required safety support activities identified?
- Were roles, responsibilities, and authorities for the work activity defined and executed appropriately?
- Were the worker qualifications required to safely perform the work identified?
- Were the design, operation, and configuration of equipment known and considered in work planning?
- Were the characteristics of the work environment known and considered in work planning?

### **Function #2: Identify and analyze the hazards.**

- Were the type and magnitude of all possible hazards clearly understood?
- Was the accident potential analyzed?
- Were the consequences of potential accidents described and understood by line management, supervisors, and workers?
- Did the workers provide input to the hazard analysis?
- Did the workers receive any feedback regarding their input?
- Were the standards and requirements associated with the hazards identified?

### **Function #3: Develop and implement hazard controls.**

- Were required physical and engineering hazard controls evaluated for likely effectiveness under the expected work conditions?
- Were the required administrative controls, such as technical procedures and safety support personnel, in place?
- Were the workers qualified and given hazard- or activity-specific training?
- Was a proper review, approval, and configuration control process in place?

**Table D-1. These are typical questions for addressing the five core functions of integrated safety management. (Continued)**

**Function #4: Perform work within controls.**

- Was the readiness to perform the work checked and confirmed prior to starting work?
- Was appropriate authorization received to start work?
- Was the work performed as planned (i.e., by the intended workers using the pre-approved procedures with the required level of supervision and safety support present with effective hazard controls in place)?
- Were the workers empowered to stop work if unanticipated or unsafe conditions arose?

**Function #5: Provide feedback and continuous improvement.**

- Was there a system to collect and use feedback from workers on workplace hazards?
- Were workers aware of any hazards affecting the work activity that were not addressed in planning for it?
- Was management made aware of the hazard(s) identified by the workers?
- Were there any lessons learned locally, from audit or evaluation results or from external operating experience, that applied to the work activity but were not addressed in planning for it?

**Table D-2. These are typical questions for addressing the seven guiding principles of integrated safety management.**

**Guiding Principle #1: Line management is directly responsible for the protection of the public, workers, and the environment.**

- Did DOE assure and contractor line management establish documented safety policies and goals?
- Was ISM fully implemented down to the activity level at the time of the accident?
- Was DOE line management proactive in assuring timely implementation of ISM by line organizations, contractors, subcontractors, and workers?
- Were ES&H performance expectations for DOE and contractor organizations clearly communicated and understood?
- Did line managers elicit and empower active participation by workers in safety management?

**Guiding Principle #2: Clear lines of authority and responsibility for ensuring safety shall be established and maintained at all organizational levels within the Department and its contractors.**

- Did line management define and maintain clearly delineated roles and responsibilities for ES&H to effectively integrate safety into sitewide operations?
- Was a process established to ensure that safety responsibilities were assigned to each person (employees, subcontractors, temporary employees, visiting researchers, vendor representatives, lessees, etc.) performing work?
- Did line management establish communication systems to inform the organization, other facilities, and the public of potential ES&H impacts of specific work processes?
- Were managers and workers at all levels aware of their specific responsibilities and accountability for ensuring safe facility operations and work practices?
- Were individuals held accountable for safety performance through performance objectives, appraisal systems, and visible and meaningful consequences?
- Did DOE line management and oversight hold contractors and subcontractors accountable for ES&H through appropriate contractual and appraisal mechanisms?

**Guiding Principle #3: Personnel shall possess the experience, knowledge, skills, and abilities that are necessary to discharge their responsibilities.**

- Did line managers demonstrate a high degree of technical competence and a good understanding of programs and facilities?
- Did line management have a documented process for assuring that DOE personnel, contractors, and subcontractors are adequately trained and qualified on job tasks, hazards, risks, and Departmental and contractor policies and requirements?
- Were mechanisms in place to assure that only qualified and competent personnel were assigned to specific work activities, commensurate with the associated hazards?
- Were mechanisms in place to assure understanding, awareness, and competence in response to significant changes in procedures, hazards, system design, facility mission, or life cycle status?
- Did line management establish and implement processes to ensure that ES&H training programs effectively measure and improve performance and identify training needs?
- Was a process established to ensure that (1) training program elements are kept current and relevant to program needs, and (2) job proficiency is maintained?

**Table D-2. These are typical questions for addressing the seven guiding principles of integrated safety management. (Continued)**

**Guiding Principle #4: Resources shall be effectively allocated to address safety, programmatic, and operational considerations. Protecting the public, the workers, and the environment shall be a priority whenever activities are planned and performed.**

- Did line management demonstrate a commitment to ensuring that ES&H programs had sufficient resources and priority within the line organization?
- Did line management clearly establish that integrated safety management will be applied to all types of work and address all types of hazards?
- Did line management institute a safety management system that provided for integration of ES&H management processes, procedures, and/or programs into site, facility, and work activities in accordance with the Department of Energy Acquisition Regulation (DEAR) ES&H clause (48 CFR 970.5204-2)?
- Were prioritization processes effective in balancing and reasonably limiting the negative impact of resource reductions and unanticipated events on ES&H funding?

**Guiding Principle #5: Before work is performed, the associated hazards shall be evaluated and an agreed-upon set of safety standards shall be established that, if properly implemented, will provide adequate assurance that the public, the workers, and the environment are protected from adverse consequences.**

- Was there a process for managing requirements, including the translation of standards and requirements into policies, programs, and procedures, and the development of processes to tailor requirements to specific work activities?
- Were requirements established commensurate with the hazards, vulnerabilities, and risks encountered in the current life cycle stage of the site and/or facility?
- Were policies and procedures, consistent with current DOE policy, formally established and approved by appropriate authorities?
- Did communication systems assure that managers and staff were cognizant of all standards and requirements applicable to their positions, work, and associated hazards?

**Guiding Principle #6: Administrative and engineering controls to prevent and mitigate hazards shall be tailored to the work performed and associated hazards.**

- Were the hazards associated with the work activity identified, analyzed, and categorized so that appropriate administrative and engineering controls could be put in place to prevent or mitigate the hazards?
- Were hazard controls established for all stages of work to be performed (e.g., normal operations, surveillance, maintenance, facility modifications, decontamination, and decommissioning)?
- Were hazard controls established that were adequately protective and tailored to the type and magnitude of the work and hazards and related factors that impact the work environment?
- Were processes established for ensuring that DOE contractors and subcontractors test, implement, manage, maintain, and revise controls as circumstances change?
- Were personnel qualified and knowledgeable of their responsibilities as they relate to work controls and work performance for each activity?

**Table D-2. These are typical questions for addressing the seven guiding principles of integrated safety management. (Continued)**

**Guiding Principle #7: The conditions and requirements to be satisfied for operations to be initiated and conducted shall be clearly established and agreed upon.**

- Were processes in place to assure the availability of safety systems and equipment necessary to respond to hazards, vulnerabilities, and risks present in the work environment?
- Did DOE and contractor line management establish and agree upon conditions and requirements that must be satisfied for operations to be initiated?
- Was a management process established to confirm that the scope and authorization documentation is adequately defined and directly corresponds to the scope and complexity of the operations being authorized?
- Was a change control process established to assess, approve, and reauthorize any changes to operations scope ongoing at the time of the accident?

***Appendix E***  
***Subject Index***



# E

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